

Plate Tectonics



The unifying theory of Geology

The Theory took off in the early 1960's and started a revolution in Earth Science!



⇒ It **Unified** the study of Earth Science

Provided explanations to ancient questions:

- (1) Why do earthquakes/volcanoes occur in very specific places on Earth?
 - (2) How are great mountain ranges like the Alps and Himalayas formed?
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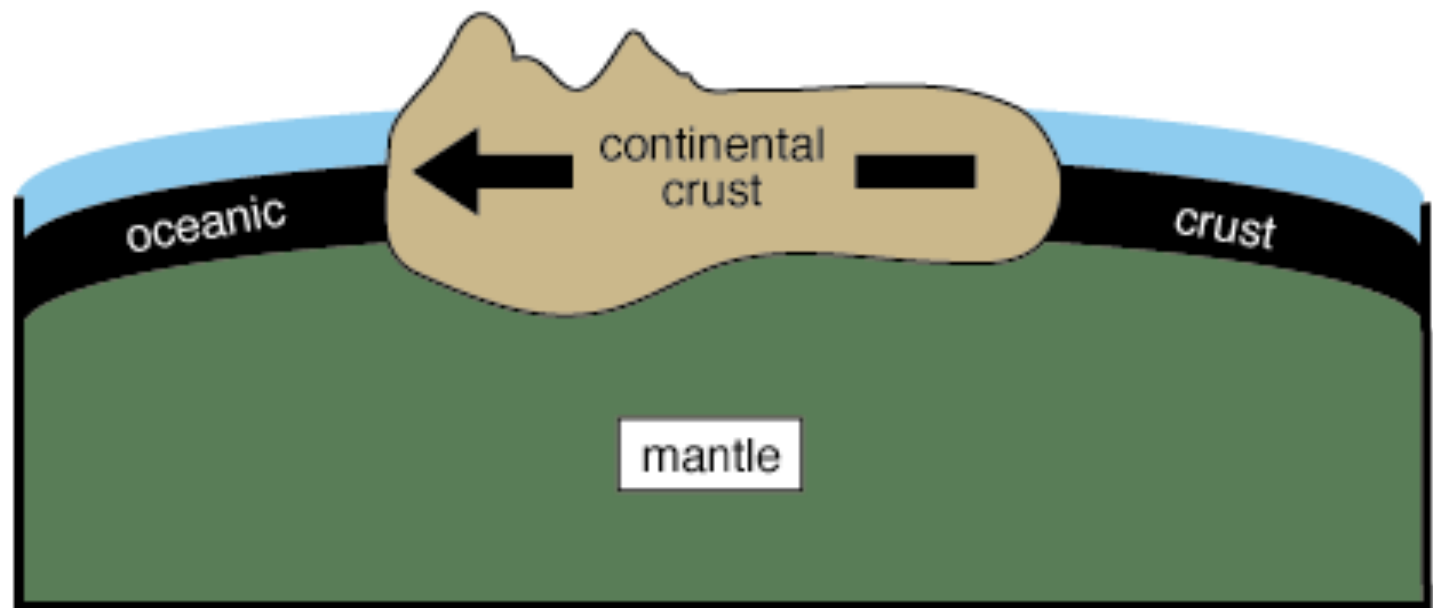
Wegener's Theory of Continental Drift had a fatal weakness:

It couldn't answer the fundamental question:
What kind of forces could be strong enough to move such large masses of solid rock over such great distances?

Wegener's answer:



The continents simply
plowed through the
ocean floor!



Wegener's proposal that continents plowed through oceanic crust was not accepted by other geologists.



Four major scientific developments had to happen after Wegener's death before his theory gained acceptance.

The First Discovery

1. Demonstration of the young age and ruggedness of the ocean floor.

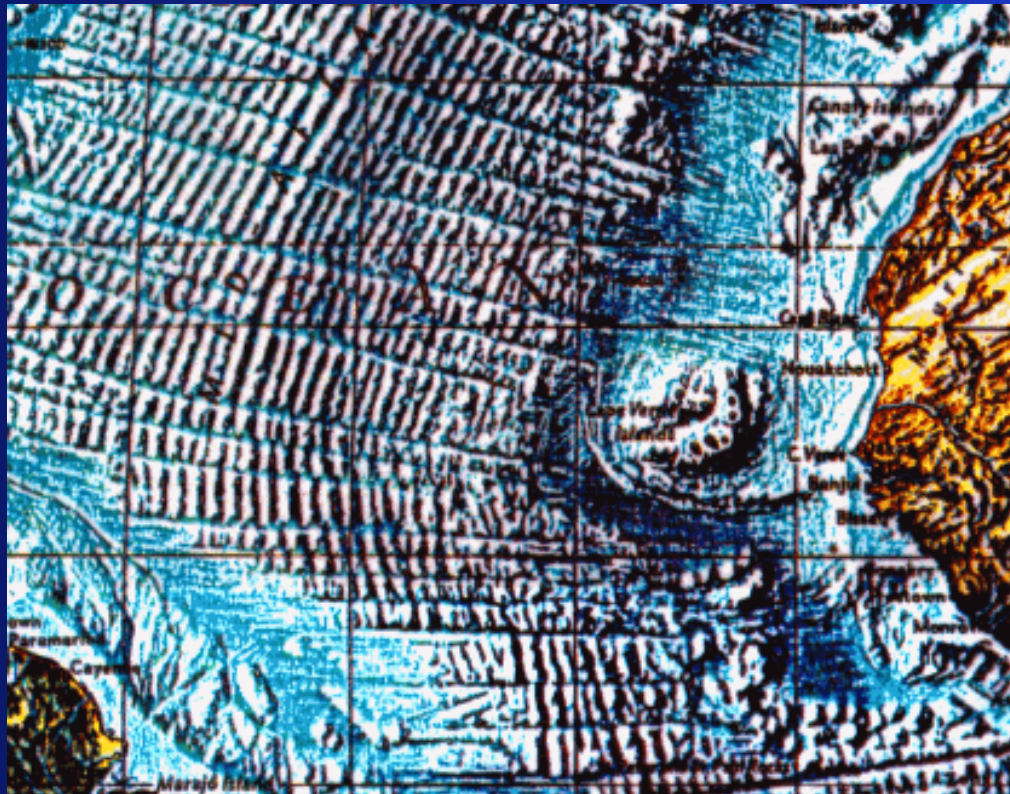
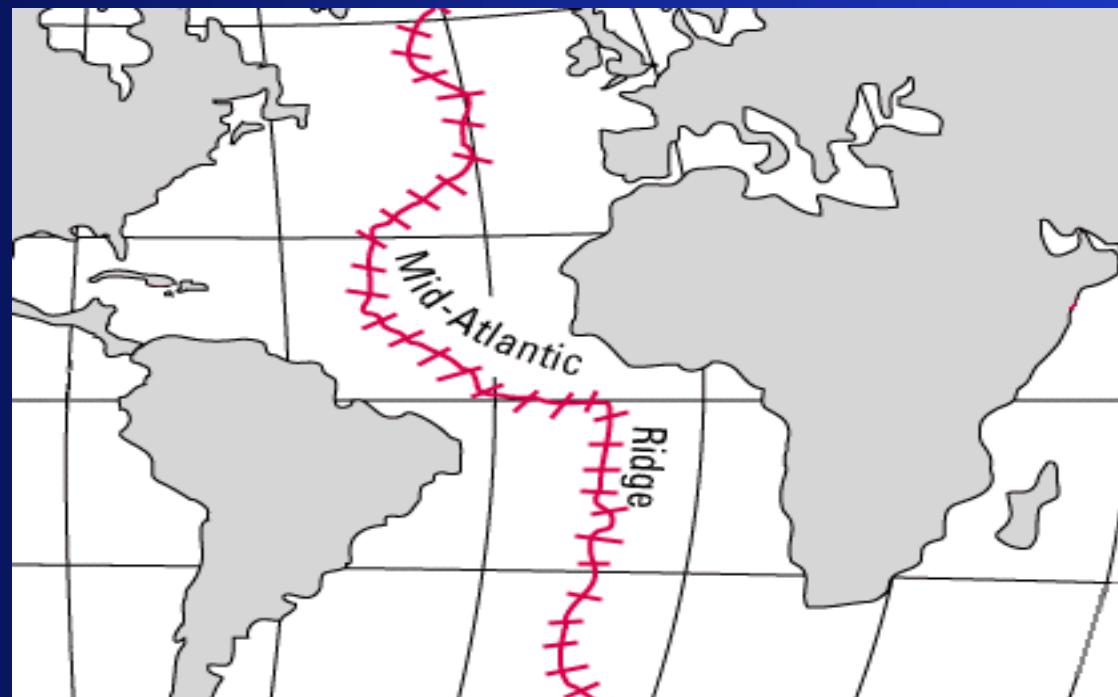


Plate Tectonics

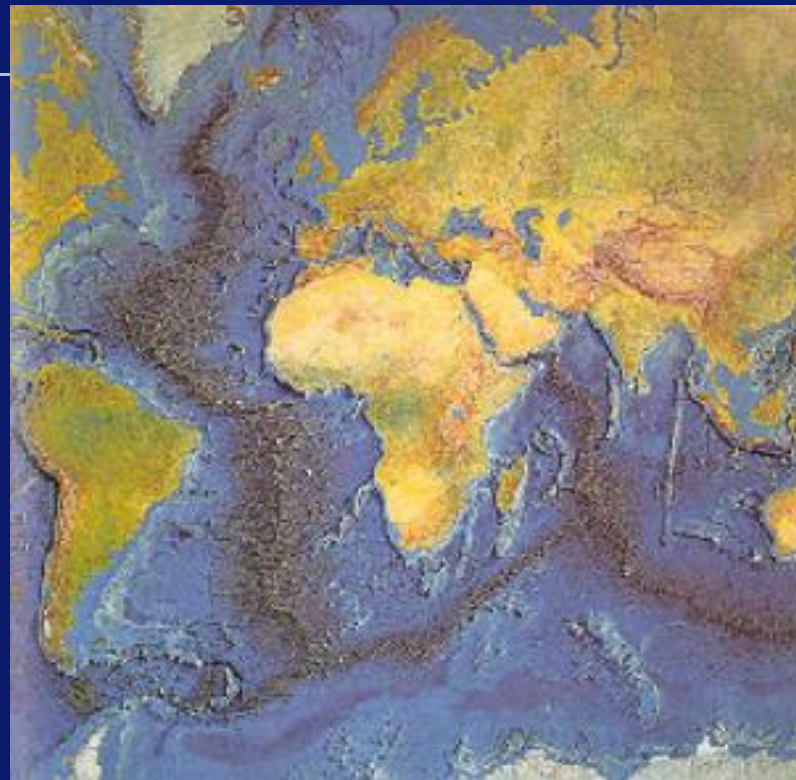
1. Scientists discovered right after World War II:
The Atlantic Ocean floor is not flat! It has a huge mountain chain down the middle, now called the Mid-Atlantic Ridge!



1. Scientists also discovered:

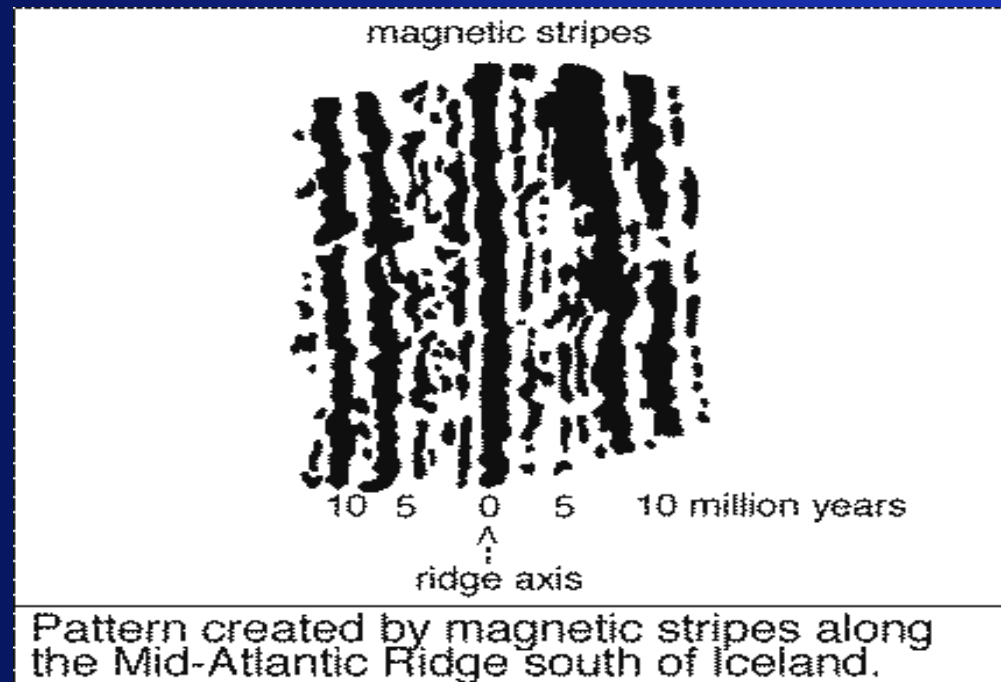
The oldest continental rock is 4 billion years.

BUT: The oldest ocean floor rock is ONLY 200 million years.

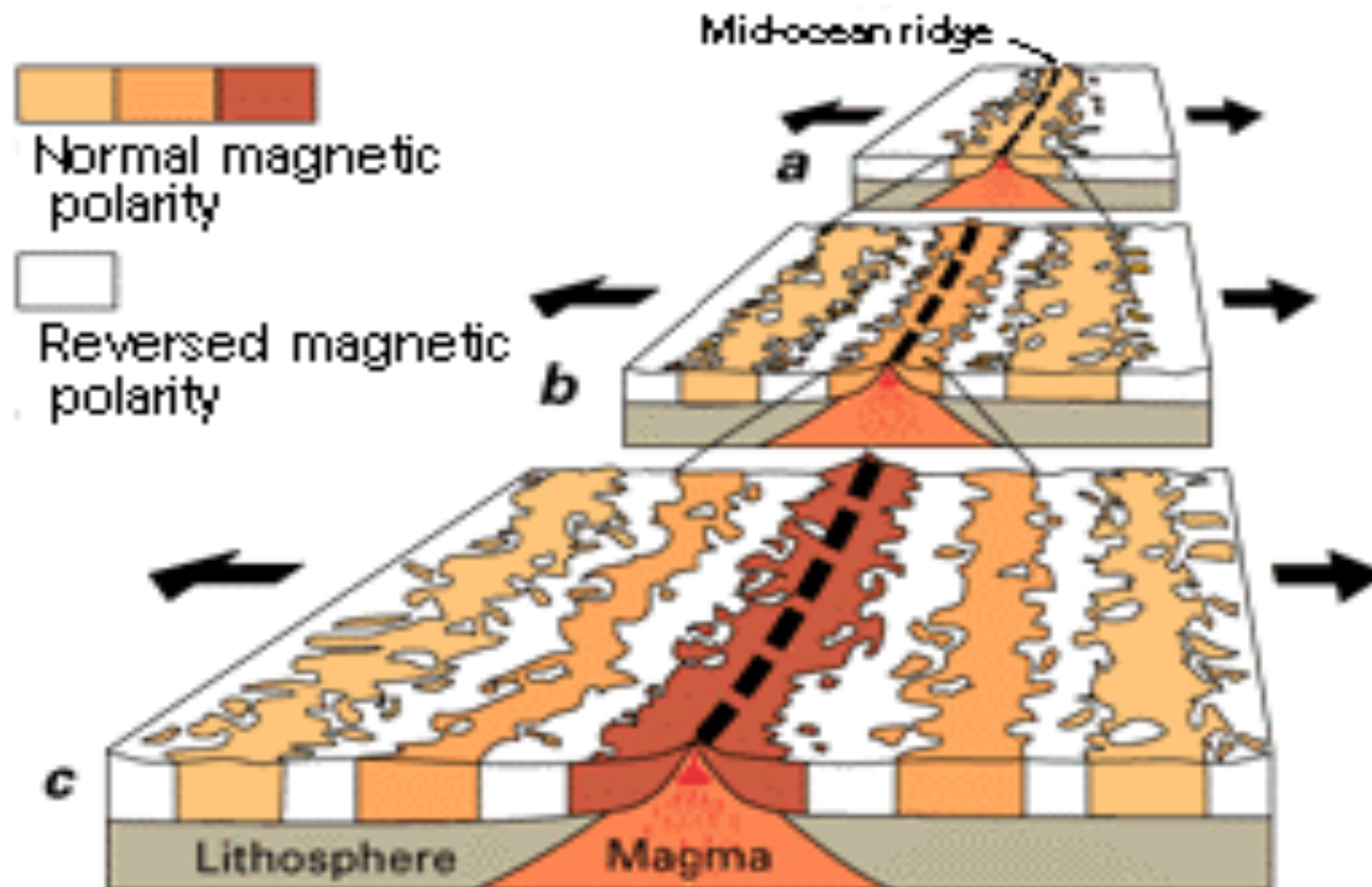


The Second Discovery

2. Reversals of the Earth's magnetic field on the ocean floor near the Mid-Atlantic Ridge

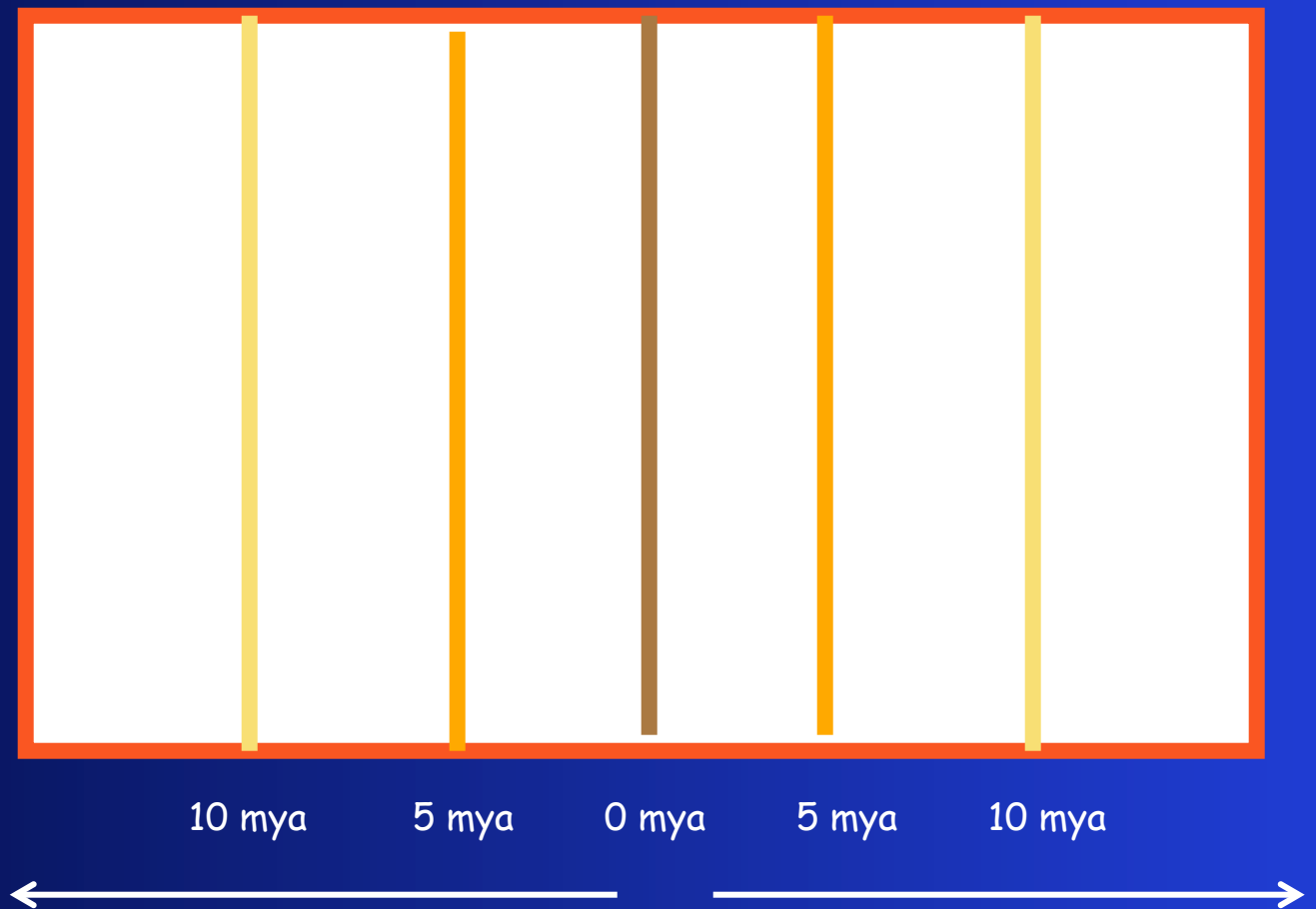
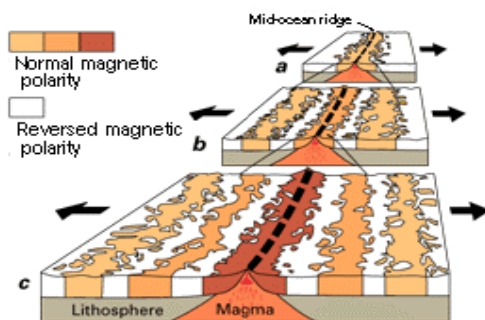


Magnetic striping



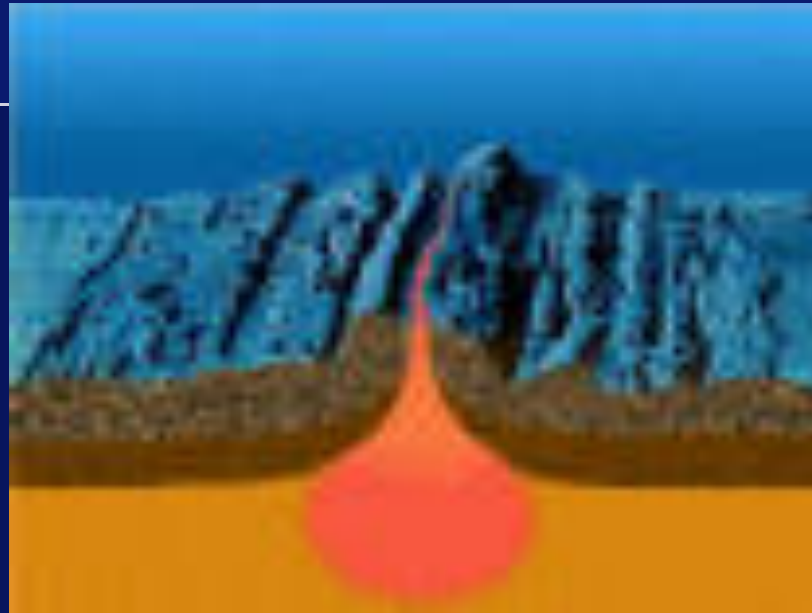
Draw this on your paper:

Mid-Atlantic
Ridge



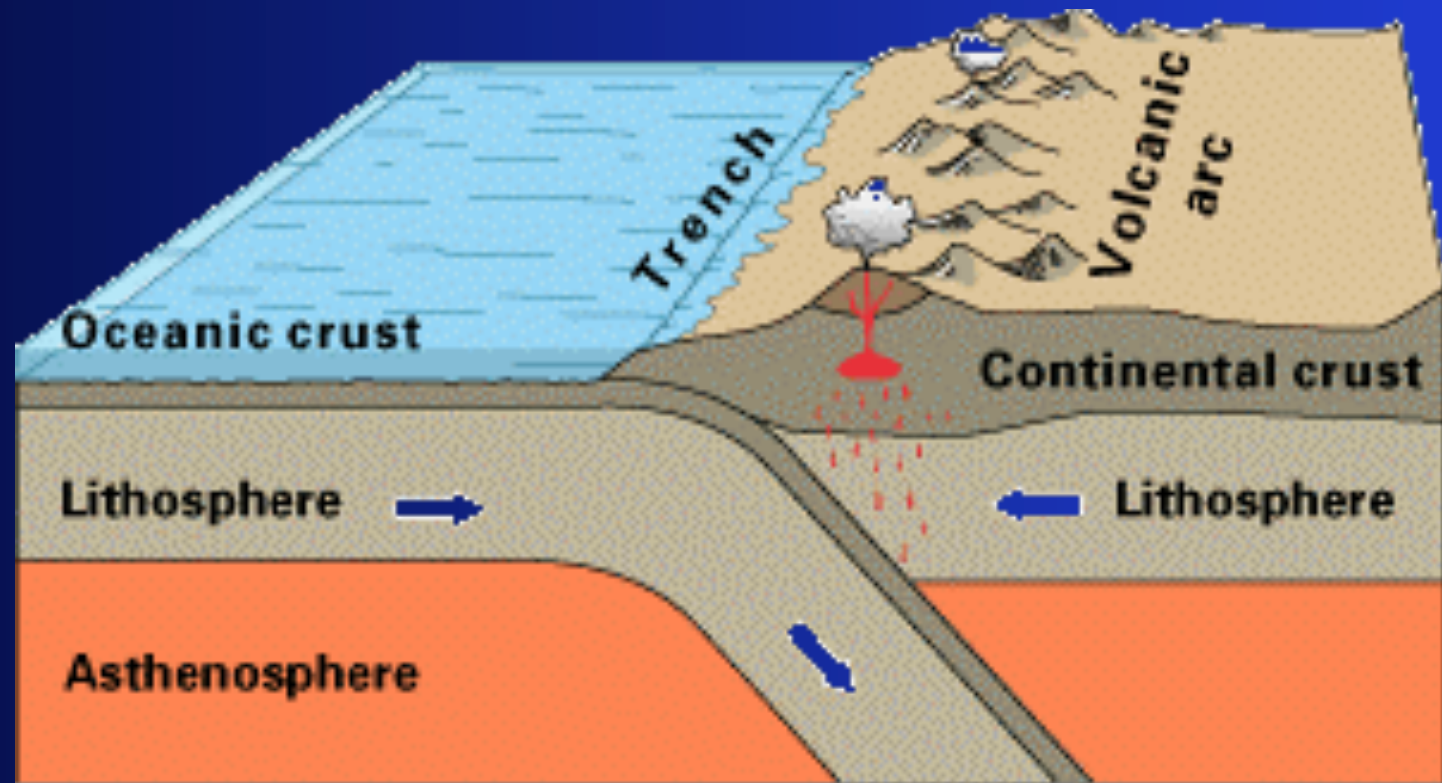
The Third Discovery

3. Seafloor Spreading Theory which introduced the concept of the recycling of the oceanic crust.



New magma rises through the ridge
and new oceanic crust is created...

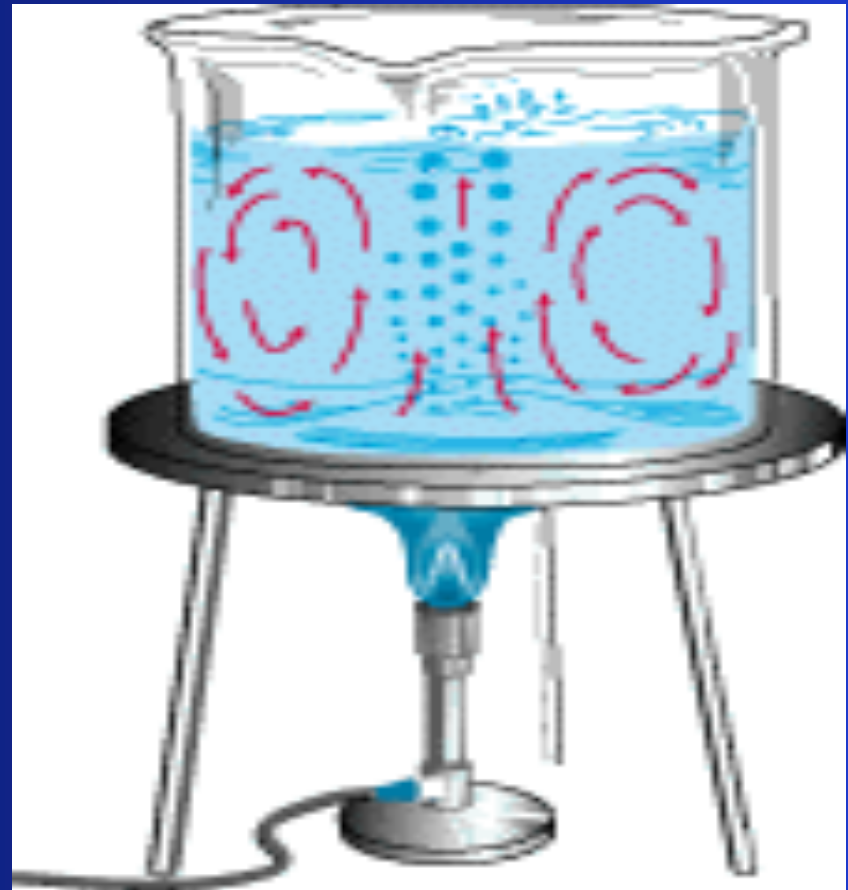
3...then the old crust plunges down into the
Asthenosphere, melting back into new magma...



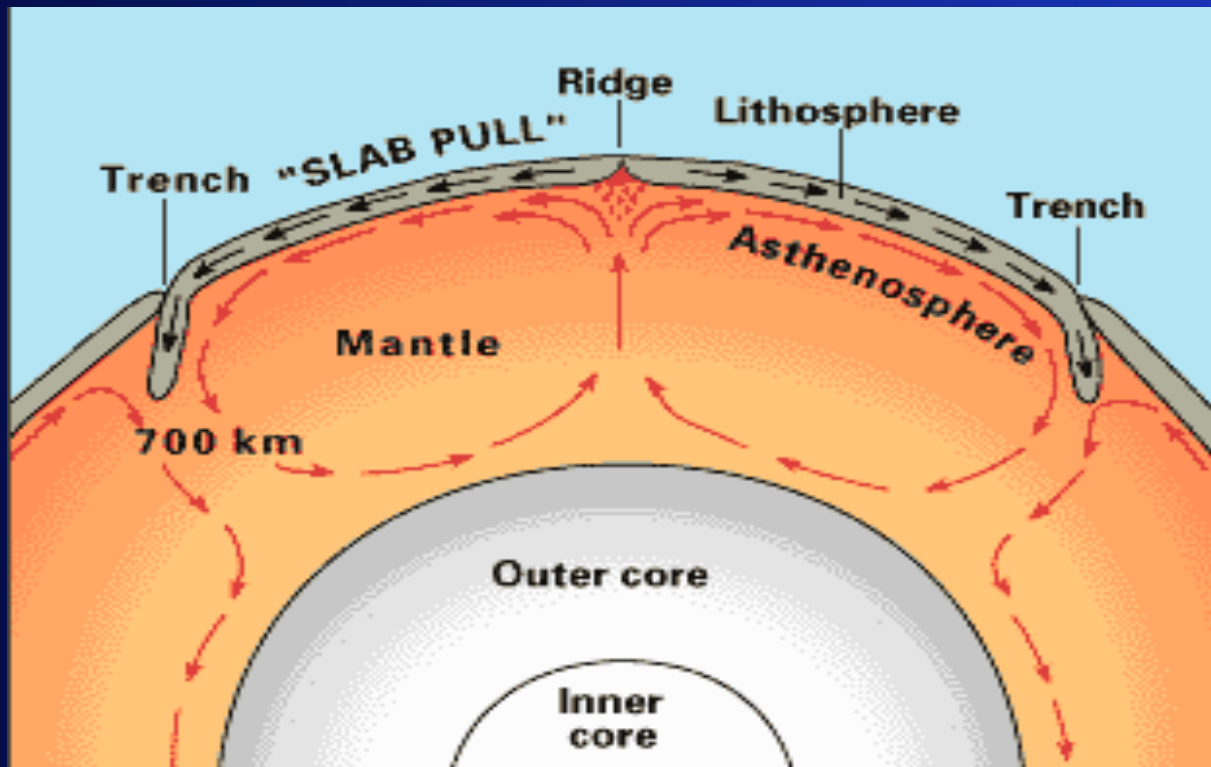
Oceanic-continental convergence

Seafloor Spreading is caused by **Convection Currents** in the Asthenosphere.

Hot water,
air, and
magma rise
because of low
density and
sink because
of high
density.

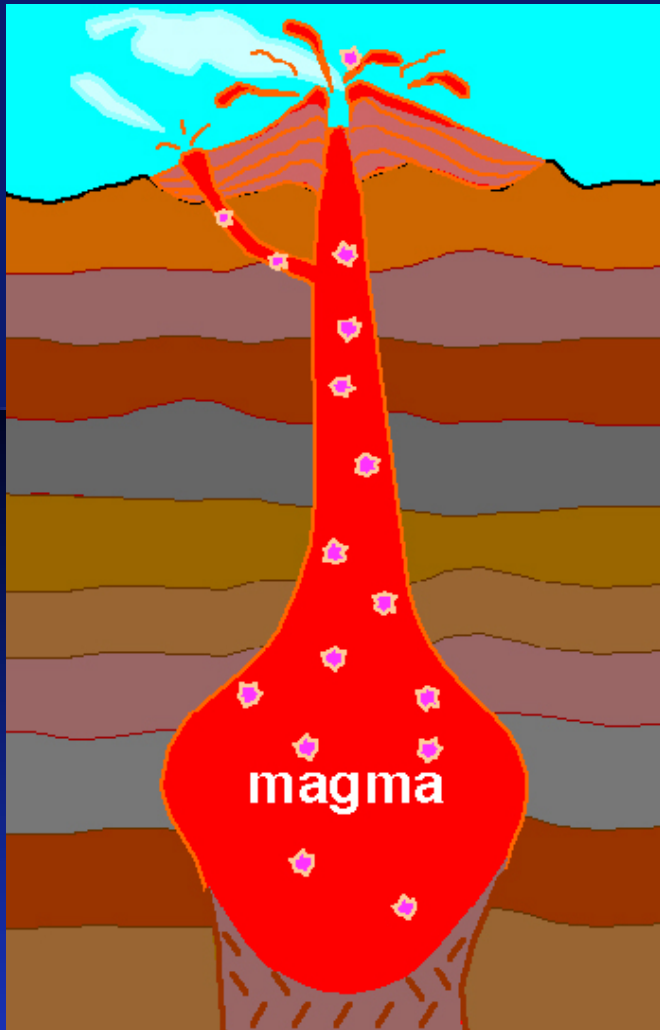


Seafloor Spreading



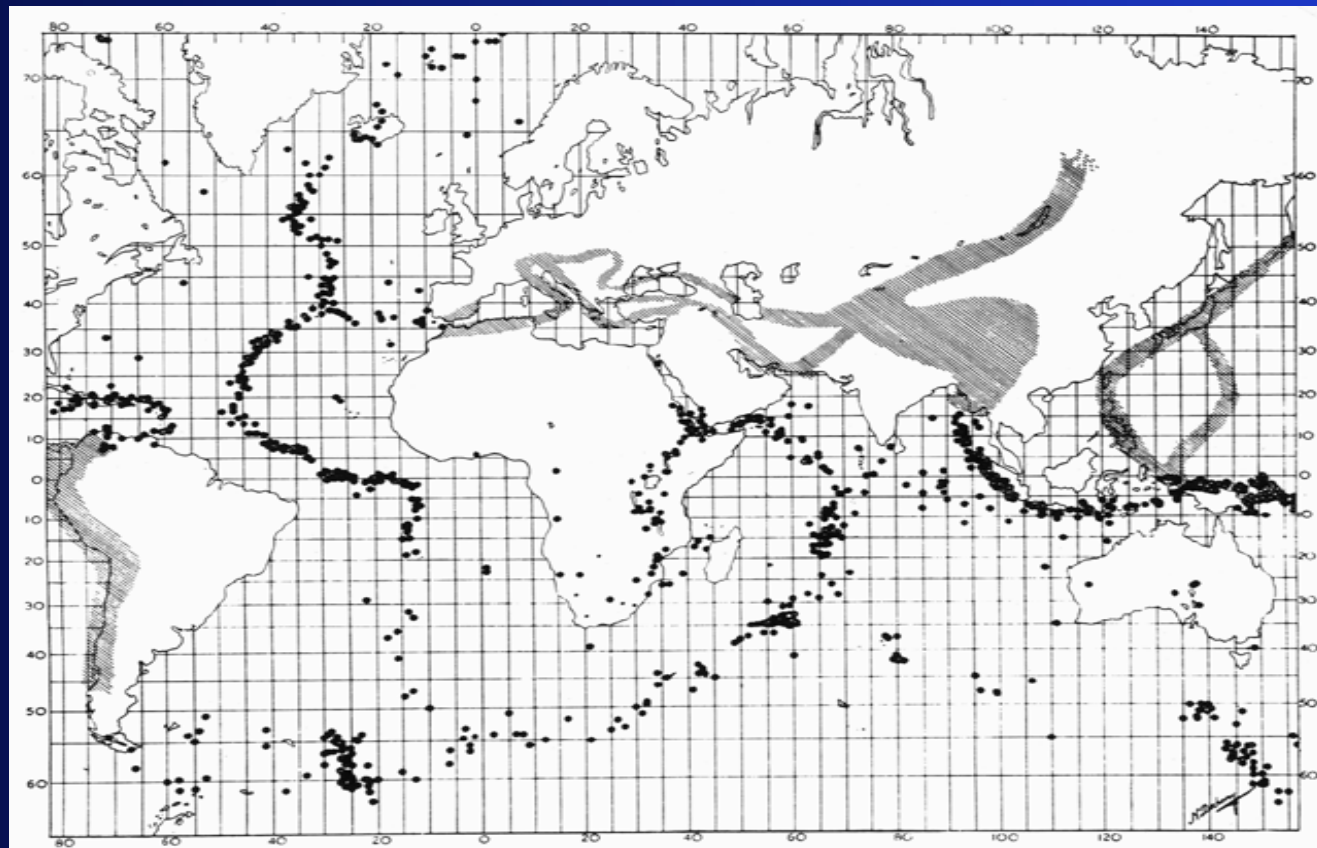
The plates are dragged along like a Conveyor Belt ("Slab-Pull").

The Fourth Discovery

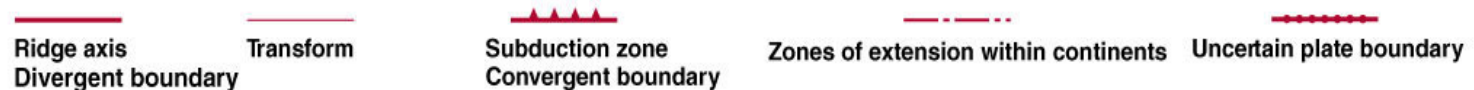
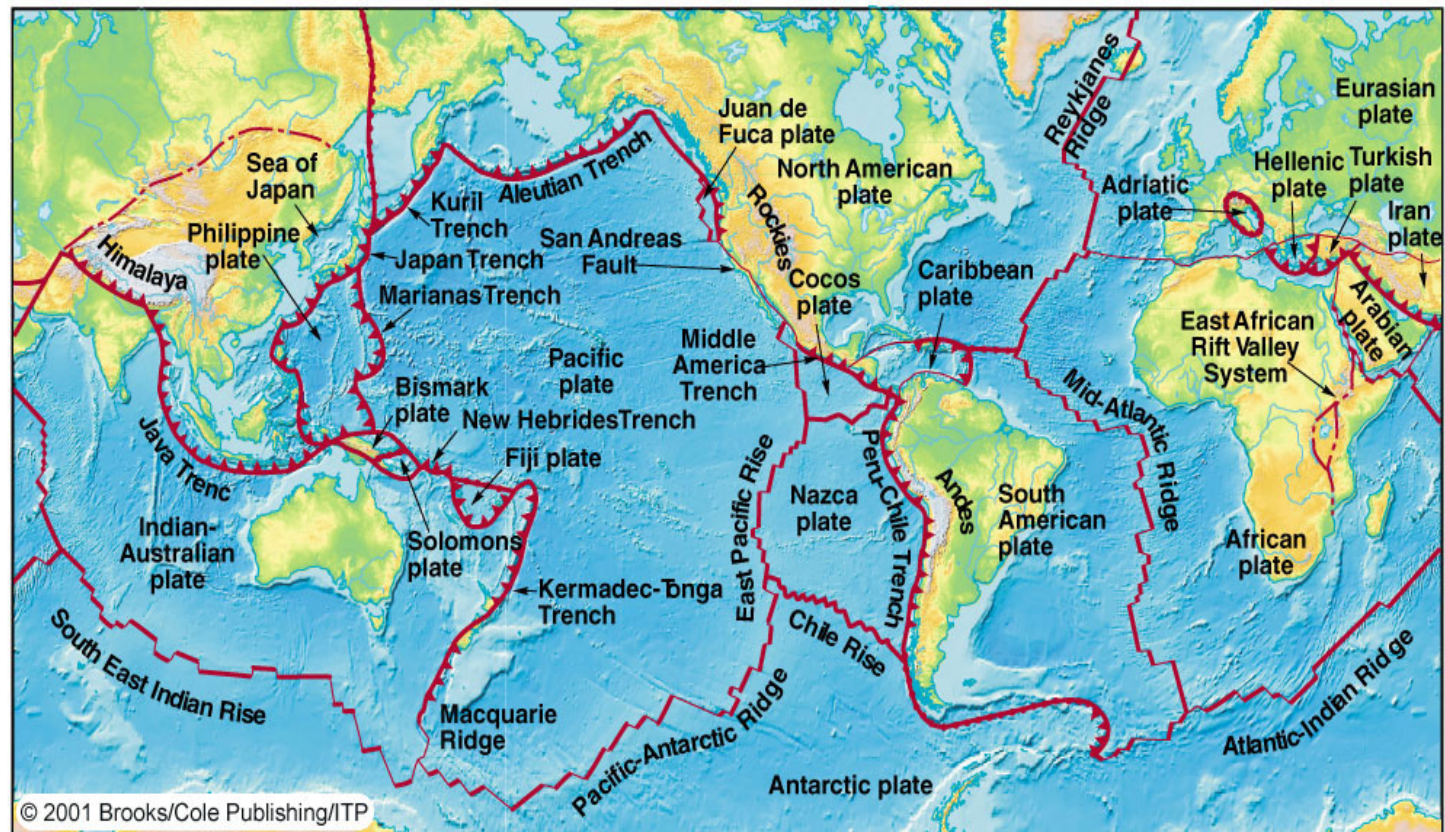


4. The precise documentation that the world's earthquake and volcanic activity is concentrated along oceanic trenches and ridges.

Earthquakes and Volcanoes are concentrated along Lithospheric Plate boundaries.



Lithospheric Plates



Once these discoveries were made:



Wegener's Theory of Drifting Continents was accepted by scientists because we could explain how continents moved.

And the REASON the plates move is:

